COMPETITIVE ABILITY OF CEREAL CULTIVARS WITH GREEN FOXTAIL

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ABSTRACT:

Interactions occur among plants in their struggle to obtain resources for growth and development. The outcome of these interactions is assessed in terms of competitive ability. A study was conducted in 1991 and 1992 to determine whether differences exist in the competitive ability of Waldern oat, Riel oat, Calibre oat, Harrington barley, CDC Makwa wheat, Gazelle rye and wild oat with low and high densities of green foxtail. At the low density of green foxtail, Harrington barley proved to be the superior competitor in 1991 whereas in 1992 there were no differences between the crop treatments. In 1991, at the high green foxtail density, Harrington barley was superior to all other crop cultivars except CDC Makwa wheat. In 1992 Harrington barley and wild oat proved to be the most competitive at the high green foxtail density. Studies such as this can provide valuable information to be applied to integrated weed management systems.

Key words: green foxtail, Setaria viridis (L.) Beauv., competition

INTRODUCTION:

Plants compete with one another to obtain moisture, light and nutrients from the environment. The outcome of this competition is measured in terms of competitive ability. Competitive ability is a measure of how strongly one individual is able to suppress another or in what manner an individual responds to the presence of competitors. The competitive effects of a weed depend on the associated crop, the crop/weed densities, the relative time of emergence of the weed and the crop and environmental conditions.

The objective of this study was to assess the competitive ability of selected cereal cultivars with green foxtail (Setaria viridis (L.) Beauv.). In a survey conducted by Alex et al (1972) green foxtail was reported to be present in 32% of the Saskatchewn fields surveyed. The amount of yield reductions that are realized can vary greatly from year to year. In wheat green foxtail is most competitive when it emerges with or shortly after the crop (Blackshaw et al, 1981). Low temperatures and low soil moisture at the time of seeding can cause substantial delays in the germination of green foxtail seeds, which can result in a competitive advantage for the crop. Vanden Born (1971) reported that green foxtail seeds germinated readily at temperatures from 15 to 35 C, though it took seven days longer to reach maximum germination at 15 C than at 30 C.

MATERIALS AND METHODS:

Field experiments were conducted in 1991 and 1992 at the Kernen Crop Research Farm, University of Saskatchewan. The experiment was designed as a completely random split-plot with six replicates. Plot size was 4.6 metres by 1.0 metres. The weed treatments were the main plots and the crop treatments were

Presented at the Soils and Crops Workshop, Saskatoon, Saskatchewan, February 25 and 26, 1993.

the sub-plot factors. The three weed treatments were low green foxtail (100 plants per square metre), high green foxtail (1000 plants per square metre) and no weed. The crop treatments were Waldern oat, Riel oat, Calibre oat, Harrington barley, CDC Makwa wheat, Gazelle rye, wild oat and a no crop treatment. Germination and seed size/weight of the crops were considered to adjust to a constant seeding rate of 270 seeds per square metre. Germination tests of weeds were also performed to obtain densities as close to those intended at possible. Fertilizer (11-52-0) was applied at a rate of 56 kilograms per hectare. In both years of the study the weeds were broadcast and harrowed in, and then the crops seeded. Border plots of Katepwa wheat were seeded between each of the experimental plots. Soil moisture measurements were taken at the time of seeding and in the fall, plant counts were taken in the spring and in August, above-ground biomass was taken in August along with grain yield. In this paper, however, only green foxtail counts and biomass at harvest will be reported. The data was analyzed using analysis of variance techniques.

The order of the seeding operations differed between the two years (Table 1). In 1991 the weed and the crops were seeded simultaneously. In 1992 the green foxtail was seeded prior to the crops in an effort to allow closer emergence in time of the crops and the weed.

Table 1 - Seeding and emergence dates of green foxtail and certain crops in a study conducted over two years at the Kernen Crop Research Farm, University of Saskatchewan.

	1991	1992
Seeding date of green foxtail	May 24, 1991	May 25, 1992
Seeding date of the crops	May 24, 1991	June 8, 1992
Emergence date of green foxtail	June 7, 1991	June 8, 1992
Emergence date of crops	June 1, 1991	June 12, 1992

RESULTS AND DISCUSSION:

In 1991 although average temperatures were realized, there was a substantial amount of rainfall early in the growing season whereas it was considerably dry later in the growing season. In 1992, although adequate moisture was obtained, the growing season was cool for the most part. This may account for the fact that the green foxtail densities were much lower in 1992 compared to 1991. The low temperatures in 1992 prevented the green foxtail from becoming established until much later in the growing season. This resulted in it being at a competitive disadvantage in relation to the crop.

In 1991, at the low green foxtail density, Harrington barley proved to be the superior competitor. Harrington barley suppressed both green foxtail number and biomass production to a greater extent than did any other crop (Figures 1 and 2). In 1992 the crops did not differ in competitive ability at the low green foxtail density.

At the high green foxtail density in 1991 Harrington barley was superior in its ability to suppress green foxtail biomass and densities compared to all other crop cultivars except CDC Makwa wheat (Figures 3 and 4). In 1992, at the high green foxtail density, Harrington barley and wild oat suppressed densities of the weed to the greatest extent (Figure 5) whereas biomass production by the weed was significantly less only in the Harrington barley treatment (Figure 6).

Figure 1 - Low green foxtail densities under various crop treatments (1991).

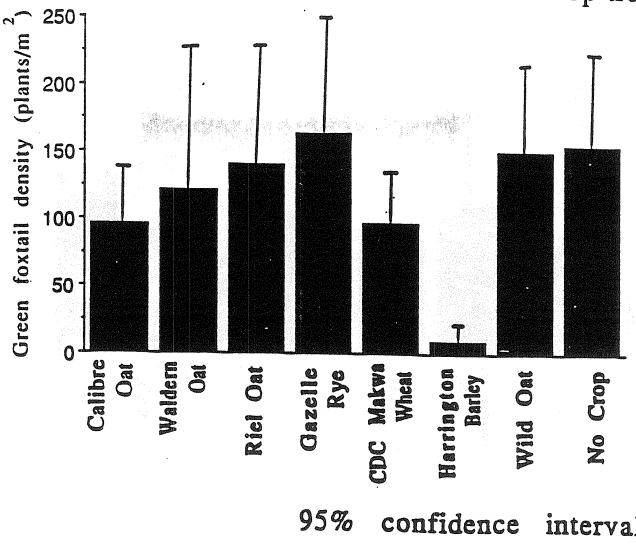


Figure 2 - Low green foxtail biomass production under various crop treatments (1991).

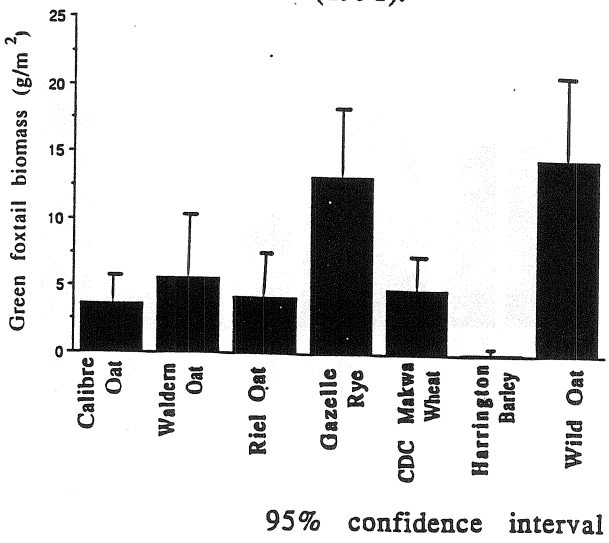


Figure 3 - High green foxtail densities under various crop treatments (1991).

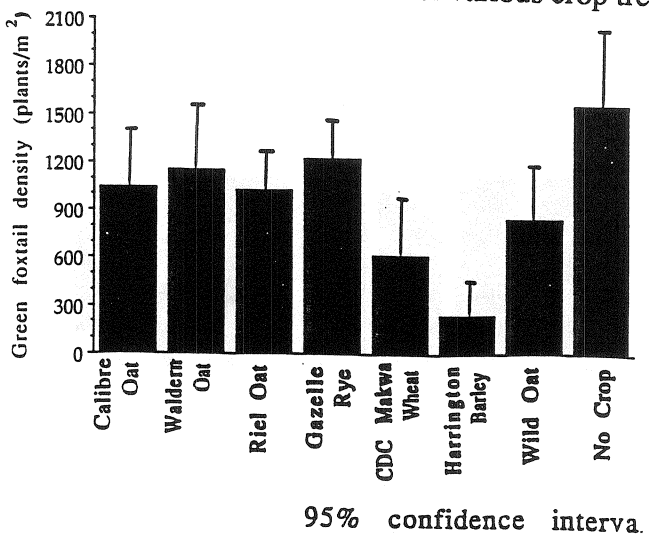


Figure 4 - High green foxtail biomass production under various crop treatments (1991).

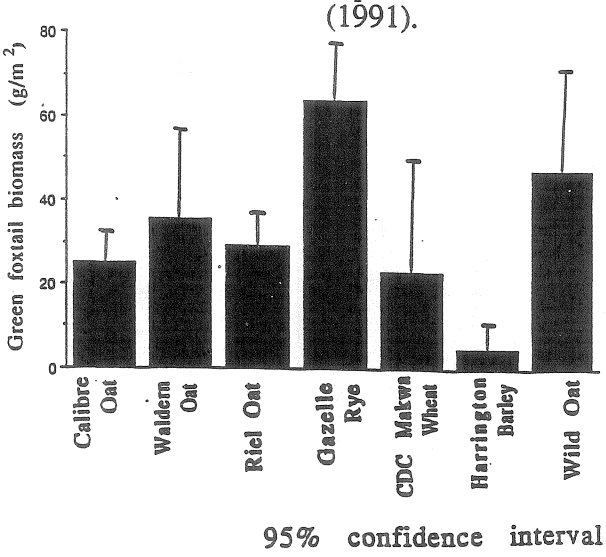


Figure 5 - High green foxtail densities under various crop treatments (1992).

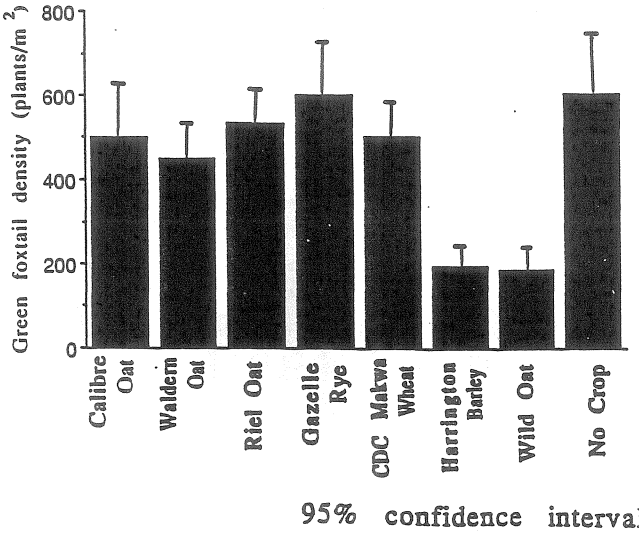
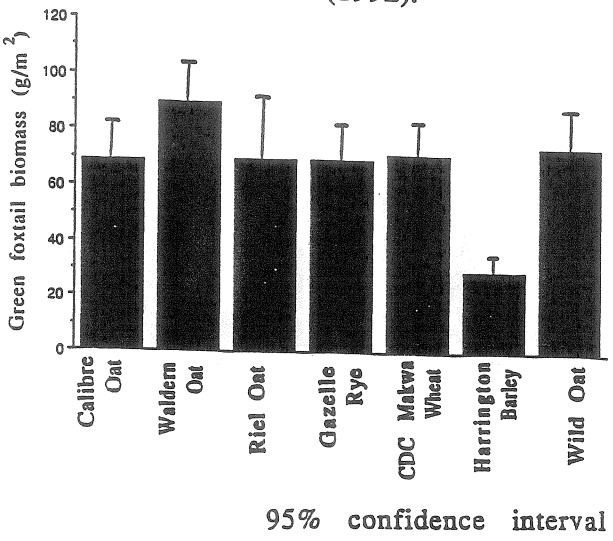


Figure 6 - High green foxtail biomass production under various crop treatments (1992).



CONCLUSIONS:

The results of this study show that Harrington barley was able to suppress green foxtail biomass production and densities to a greater extent than any of the other crop cultivars. Pavlychenko and Harrington (1934) also found barley to be a superior competitor to other cereal crops. The competitiveness expressed by barley is attributed to its 'smothering ability'. It may also be related to allelopathy.

Each weed and each species of crop has its own merits of competitive adaptation and its own reactions toward its rivals. The competitive ability of both weed and crop species is affected by the environment, plant density and spatial arrangement , the species which are competing, the duration of this interaction and the relative time of emergence. Any number of these factors can serve as the key to giving the crop the competitive advantage.

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